



**US Army Corps
of Engineers®**

Engineer Research and
Development Center

ERDC Estuary Studies

Description

Coastal and Hydraulics Laboratory (CHL) experts study the effects of tides and the interaction of fresh and seawater on estuaries for customers ranging from U.S. Army Corps of Engineers Districts to port authorities or the U.S. Environmental Protection Agency. The studies cover such factors as the following:

- Movement of tides
- Transport of salinity, mixing processes, and stratified flows
- Transport, erosion, and deposition of sediments
- Behavior and characteristics of sediment beds
- Flow between aquifers and surface waters
- Human effects on estuaries including vessel traffic, diversion, and structures
- Descriptive measurement of estuaries through in-situ and remote methods
- Predicting estuarine processes through physical and computer-generated models
- Research making work in estuaries safe, economical, and effective

Port deepening projects need such studies to predict possible environmental effects of increased salinity, sediment transport, shoaling, erosion, and issues such as whether the harbor would be harder to maintain after completion of the project, if shoreline damage would occur, or if there would be any environmental impacts from sediments or salinity intrusion. For more information, refer to the CHL Web site at

<http://chl.erd.usace.army.mil/>.

Capabilities

Researchers at CHL conduct 2-D or 3-D multidimensional numerical modeling studies; desktop studies; model development; data collection and analysis. All involve hydrodynamic salinity and sediment characteristics of estuaries in similar bodies of water.

Supporting Technology

- Computational fluid hydrodynamics using physics-based numerical computer models in which equations are based on Newton's laws of movement and acceleration
- Visualization capabilities such as the Surface-Water Modeling System which allows the user to set up, analyze, and visualize the coastal and inland waterways and wetlands areas



Barrier Island and estuary complex, southern Rhode Island

- Data collection for water levels and water velocity
- Sediment laboratory facility located at CHL that takes physical samples for evaluations

Benefits

The primary benefit of estuary studies is problem avoidance. The studies identify what the impacts may be and recommend possible mitigation. For example, if a study shows increased salinity intrusion that adversely affects oyster reefs, the study may recommend how to avoid this problem; Another example is if wetlands areas are adversely affected by the project, studies may recommend creation of new wetlands to compensate for those lost or that the project be built in a different way altogether. Other studies, however, may provide cost efficiency such as making a determination of the positioning of a channel to achieve navigation needs without adverse affects. Still other studies may be used to ensure safety such as calculation of currents studies used in conjunction with the ERDC Ship/Tow simulator for pilot safety.

Success Stories

- Model studies of problems at Daniel Island Terminal and Drum Island Reach, Charleston, South Carolina. CHL is studying new channel designs of a terminal development project involving two terminals on Daniel Island. Future navigation conditions and maintenance dredging requirements will benefit from improved channel designs.
- Erosion and circulation of dredged material in Laguna Madre, Texas. CHL is studying this area to predict the long-term fate of disposed dredge material and its effects on water column light conditions. Estuarine hydrodynamic modeling is being applied to calculate forces related to tidal and wind driven flows, and circulation in the system.
- Modeling the fate of dredged material placed at Chesapeake Bay Site 104. An investigation is being conducted to reopen this open water disposal site for dredged material from upper bay navigation channels. CHL is evaluating the potential for dredged material to leave the site and the affect on water quality. Results from the study show a potential for in excess of 10 percent of the material placed there to leave the site or subsequently be eroded. Simulations over the

proposed five years of placement show no significant impact on the water quality of the bay.

- Surface and ground water study of South Florida. CHL is working with other agencies to investigate restoration of freshwater flows through the Everglades and into Florida Bay. ERDC scientists and engineers have constructed a sophisticated system of numerical models from its Groundwater Modeling System and Surface-Water Modeling System simulating the flow of water as it moves underground, overland and through the waterways of South Florida.
- Biscayne Bay field data collection and numerical modeling of salinity and circulation. This model is being used to determine likely outcomes of a variety of freshwater flow strategies. The model is also being coupled to overland flow and groundwater model produced by CHL to provide comprehensive tools for freshwater and estuarine resources management.
- Matagorda Bay-Colorado River Diversion field data collection and numerical modeling of salinity, circulation and delta building. This effort is being used to determine ways to improve navigation in the region and assess environmental impacts of any physical changes to the system, such as creating openings between bodies of water, on the way fresh and salt water mix.

Point of Contact

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